

characteristics to the patient, for example age, sex, body measurements, etc. Further, postural sway or other neuro-muscular characteristic may be quantified and compared. Step 9 determines a patient's postural stability based on the analysis of step 8.

FIG. 6 shows a vibration quantification apparatus system according to the present disclosure. A patient stands on a vibration table 10. Vibrations, generated by table 10 for a predetermined duration, for example, 0.5 to 5 minutes, are transmitted through the patient's body. The vibrations are generated by motorized spring mechanisms 12 located underneath a standing platform 14 of the vibration table 10 and attached thereto. It is contemplated that the vibrations may be generated by a plurality of non-motorized springs or coils attached underneath the standing platform 14, upon which the standing platform 14 rests.

The frequencies imparted by vibration table 10 are in the range between 0 and 100 Hz with a peak amplitude between 0.04 and 0.4 g's. The vibration waves are preferably sinusoidal, however other waveforms are contemplated. At least one accelerometer 15 is mounted to vibration table 10 on an outboard side 16 of the standing platform 14. Accelerometer 15 is used to measure the vibrational response of the patient's musculoskeletal system. During the vibration generation of vibration table 10, the response of accelerometer 15 can be amplified by a preamplifier (not shown) as known in the art.

Thereafter, the vibrational response is measured and recorded by spectrum analyzer/computer 18 which is electrically connected to accelerometer 15 by a cable 17. The accelerometer response data is analyzed to extract information on postural sway or other neuro-muscular characteristic. Accordingly, a determination is made regarding the postural stability of the patient.

Advantages provided by the method and system of the present disclosure is that little or no training/learning is required of the patients; pathologies in the ankles, knees, hips, sensory systems, spine, etc. can be identified; age-related changes in postural stability can be characterized; changes in postural stability following surgery can be characterized; improvements associated with rehabilitation therapy can be identified; postural capability can be characterized in individuals suspected of malingering; stability of an individual in the seated position can be characterized; the method and system of the present disclosure lend themselves to the patient being in a position other than the Romberg position; and the method and system of the present disclosure can be incorporated into therapeutic or exercise type devices to provide real-time feedback on improvements in postural stability while the patient is exercising or performing a task.

Having described preferred embodiments of a novel method and system for quantifying postural sway to determine postural instability or imbalance (which are intended to be illustrative and not limiting), it is noted that modifications and variations can be made by persons skilled in the art in light of the above teachings. It is therefore to be understood that changes may be made in the particular embodiments of the invention disclosed which are within the scope and spirit of the invention as outlined by the appended claims. Having thus described the invention with the details and particularity required by the patent laws, what is claimed and desired protected by Letters Patent is set forth in the appended claims.

What is claimed is:

1. A non-invasive method for evaluating a musculoskeletal system of a patient comprising the steps of:

providing a vibration measurement device directly on a non-rigidly supported platform;

measuring a vibrational response of a patient's musculoskeletal system using the vibration measurement device after the patient rests on the non-rigidly supported platform;

performing a frequency decomposition of the vibrational response to quantify the vibrational response into specific vibrational spectra; and

analyzing the vibrational spectra to evaluate at least postural stability.

2. The method as recited in claim 1, further comprising the step of determining postural stability by evaluating the vibrational response in a frequency range of below 5 Hz.

3. The method as recited in claim 1, wherein the vibration measurement device includes an accelerometer.

4. The method as recited in claim 1, wherein the step of analyzing the vibrational spectra includes the step of comparing the vibrational spectra to vibrational spectra of a same category.

5. The method as recited in claim 4, wherein the category includes at least one of age, sex and body measurement.

6. The method as recited in claim 1, wherein the step of measuring includes measuring the vibrational response of the neuro-muscular system for a predetermined amount of time.

7. The method as recited in claim 6, wherein the predetermined amount of time is between 0.1 minute to 5 minutes.

8. A non-invasive physiological vibration quantification system for evaluating a musculoskeletal system of a patient, the system comprising:

a non-rigidly supported vibration table;  
vibration means for transferring vibrations to the musculoskeletal system and including an accelerometer for measuring a response by the musculoskeletal system in accordance with the vibrations transferred by the vibration means and for forming signals representative of the musculoskeletal system response, the accelerometer being mounted directly on the non-rigidly supported vibration table; and

an analyzer coupled to the vibration measurement device for receiving the signals from the vibration measurement device and developing a frequency spectrum associated with the signals, the frequency spectrum providing vibrational quantification of the musculoskeletal system for evaluating at least postural stability.

9. The system as recited in claim 8, wherein the vibration table generates frequencies amplitudes between 0 Hz to 100 Hz.

10. The system as recited in claim 8, wherein the vibration table generates peak amplitudes between 0.04 g's to 0.4 g's.

11. The system as recited in claim 8, wherein the vibration measurement device includes a solid state accelerometer.

12. The system as recited in claim 8, further comprising a recording means for recording vibrational responses of the patient's musculoskeletal system.

13. The system as recited in claim 8, wherein the frequency spectrum includes a response in a frequency range of below 10 Hz for determining postural stability.

14. A non-invasive method for evaluating a musculoskeletal system of a patient supported on a vibration table comprising the steps of:

transferring vibrations to the musculoskeletal system;  
providing a vibration measurement device including an accelerometer directly on the vibration table for mea-

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suring a response by the musculoskeletal system in accordance with the vibrations transferred and for forming signals representative of the musculoskeletal system response; and developing a frequency spectrum associated with the signals, the frequency spectrum providing vibrational quantification of the musculoskeletal system for evaluating at least postural stability.

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15. The method as recited in claim 14, wherein the step of transferring vibrations is performed while the patient is exercising.

16. The method as recited in claim 14, wherein the step of transferring vibrations is performed while the patient is either at rest or performing a task.

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